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APPLICATION OF DIFFERENTIAL EQUATIONS IN THE PHARMACEUTICAL INDUSTRY

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Abstract

Today, due to globalization, technology is improving every year, new knowledge and research in the field of medicine is emerging. To create technology, scientists need calculations, where they can't do anything without differential equations. Activities in the world are changing medical personnel related to mathematical modeling, statistics applied in practice and other phenomena.

Specialists in economics are expected to apply their knowledge and skills in a variety of fields. We will consider the application of mathematical knowledge in medicine in the formation of professional competencies. In this article, the role of mathematics in medicine is to assist in the implementation of diagnostic procedures. At present, the methods of treatment and diagnosis of diseases have been significantly expanded. Some areas of medical centers use mathematical modeling techniques to increase the accuracy of the diagnosis. Physicians' knowledge of the basics of mathematics is used to study the properties of the processes that take place in the human body. As an example, dissolving drugs in tablet form. The "solution" is intended to determine the amount of substance that affects the experiment and to convert it from a solid form into a solution in a specific dosage over a period of time under the conditions specified in the manual or according to the normative documents.

Keywords: Model, differential equation, integral, logarithm.

Introduction

It requires deep high-quality knowledge from specialists for the processes taking place in the world now. Today, thanks to globalization, technologies are improving every year, new knowledge and research is emerging in the field of Medicine.

To create technology, scientists need calculations, where they cannot do anything without differential equations. In the world, activities are changing in mathematical modeling related to medical personnel, statistics and other phenomena used in practice.

Economic education specialists provide for the application of their knowledge and abilities in various fields. Let's consider mathematical knowledge in the formation of professional competencies through the application of it in medicine.

The role of mathematics in medicine consists in helping to carry out diagnostic procedures. Currently, the methods and diagnosis of treatment of diseases are significantly expanded. Mathematical modeling in certain areas of medical centers uses methods, which increases the accurate diagnosis.

Knowledge of the basics of mathematics by doctors is used in the study of the features of processes that occur in the human body. Many education institute students study mathematics alongside basic medical subjects. The main problem in Applied Mathematics is the choice of a mathematical model, which you will not notice in any field of knowledge, as in biology and medicine.

The subject of" differential equations " is one of the largest sections in modern mathematics. It intersects with many areas of activity.

Initially, a differential equation is a derivative equation that contains the Unknown, or a function under the differential symbol. They are the basis for the compilation of scientific works applied and developed in production important for modern economics and other fields.

Also differential equations are widely used in practice. For example, the result of chemical reactions, calculation of most of the company's income, current power dynamics over time, the demographic situation in a particular region is calculated using differential equations.

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Literature Analysis and Methodology

The topic of this work will always be relevant, since mathematical methods are used in solving many issues, including in the field of Medicine.

Every year, scientists identify new diseases, find drugs, new methods of treatment, and none of this is halved without Mathematics.

Discussion

Let's consider the tasks of applying differential equations to solve what is used in a particular medicine.

Dissolving pill-shaped medicinal substances

The ”solution" experiment is intended to determine the amount of the substance affected, coming into the form of a solution from a strictly dosed solid form within a certain period of time, under the conditions specified in the manual or according to regulatory documents. Let's say where t is the melting time, n is the amount of substance in the tablet.

In it

$$\frac{dn}{dt} = -kn.$$

where k is the constant melting rate. The minus in this equation means that over time, the amount of substance in the form of a drug begins to decrease.

Consider the solution.

In the differential equation, we separate and integral the variables:

$$\frac{dn}{n} = -kdn,$$

$$\int \frac{dn}{n} = -\int kdt$$

From this we obtain:

$$ln|n| = -kt + ln|C|$$

Using the logarithm property, one obtains:

$$|n| = C_1 e^{-kt},$$

where $C1 = e^c$ is an arbitrary constant number.

In terms of the modular property, we obtain:

$$n = C_2 e^{kt},$$

Where $C_2 = \pm C_1$ is an arbitrary constant.

$t = 0$ $n = n_0$ ekanini hisobga olsak, quyidagini hosil qilamiz $C_2 = n_0$, ya'ni:

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considering that $t = 0$ is $n = n_0$, we obtain $C_2 = n_0$, that is:

$$n = n_0 e^{-kt}$$

The following formula refers to the integral form of the law of dissolution of a substance in the form of a drug.

$$n = n_0 e^{-kt}$$

from the equation we find the constant scattering rate k:

$$K = \frac{1}{tln(\frac{n_0}{n})}$$

The half-melting period of the tablets is $t = t_{\frac{1}{2}}, n = \frac{n_0}{n}$::

$$\frac{n_0}{2} = n_0 e^{-kt_{\frac{1}{2}},}$$

$$\frac{1}{2} = e^{-kt_{\frac{1}{2}}}$$

Let us logarithm the two sides of the equation:

$$ln\frac{1}{2} = -kt_{\frac{1}{2}}$$

representing $t_{\frac{1}{2}}$, $t_{\frac{1}{2}} = \frac{ln2}{k} = \frac{0{,}693}{k}$ we get.

The result and its discussion: now let's consider an example of the breakdown of the drug in the human body.

A condition of the example is:

A drug was injected into the patient's body, how much of it will break off after 8 hours, if 4 hours after the administration of 4 mg of the drug, its weight was reduced by two times?

Solution:

To solve this problem, it is necessary to periodically establish a dependence on the change in the amount of the drug in the body.

To say the number of drug quantity (mg) $N_0 = 8$ at the initial time. After two hours, the number of drug amounts will be $N_2 = 4$, where N is the number of drug amounts at any time. The rate of change in the amount of the drug is proportional to the amount of the number of drugs at a certain time:

$$\frac{dN}{dt} = kN$$

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By solving this differential equation, the following sought-after relationship can be found:

$$N = Ce^{kt}$$

We Define C according to the initial condition:

$$8 = Ce^{k0},$$

so $e^0 = 1, \quad C = 8$

So $N = 8e^{kt}$. It is known that after the administration of the drug to the body, after 4 hours, its mass was reduced by two times. we define k. To do this, putting $t = 4$ in the last equation, we have the following in value $N = 4$:

$$4 = 8e^{k4},$$

$$0{,}5 = e^{4k}$$

If we log both sides of the equation, we get:

$$ln0{,}5 = lne^{4k},$$

$$ln0{,}5 = 4k\ lne$$

If $lne = 1$, then

$$k = \frac{ln0{,}5}{4}$$

The dependence of the amount of Medicine in the body can be written by time as follows:

$$N = 8e\frac{ln0{,}5}{4}t$$

Now we will find out the amount of the substance after 8 hours (8 = 4), for which, putting the time in the equation, we will have:

$$N = 8e\frac{ln0{,}5}{4} \times 8.$$

$$N = 8e^{\ln(0{,}5)\times 2}$$

If $ln0{,}5 = -0{,}693\ , then\ \ln(0{,}5) \times 2 = -1{,}386.$

Thus,

$$N = 8e^{-1{,}386} = 8 \times 0{,}25 = 2.$$

After 8 hours, 2 mg of the drug remains in the body. During this time, 8-2 = 6 mg disintegrated. As a result, 6 mg of the substance was broken down within 8 hours.

Conclusion

In our examples, these laws are expressed in the form of differential equations. Mathematical models make it easier to predict the results of an experiment conducted in real systems, to study the phenomenon as a whole, to predict its development, changes that will occur over time.

In the presented work, we examined the use of differential equations to solve problems in medicine using the example of a model of dissolving dosage forms of a substance from tablets, modeling the treatment of diseases.

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